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ART. III. — *The Conflict of Studies, and other Essays on Subjects connected with Education.* By I. TODHUNTER, M. A., F. R. S.
London : Macmillan & Co. 1873.

AMONG the most advanced nations, in this age of sceptical inquiry, — an age sceptical in the old and good sense of the word (noting that close examination of a subject which orthodox philosophers and divines have for so many centuries stamped with a black mark), — in this age nothing seems likely to escape a radical re-examination by discussion and experiment. Those matters for which a genuine loyalty might still be counted on to conserve past usages, the means, influences, and appliances to which scholars and men of culture acknowledge their deepest indebtedness, have not proved exceptions. We might even expect next that radicals will begin to call in question the superior amiability and attractiveness of their several mothers, wives, or children ; so stern is their repression of presumptions *à priori*, and so strong a motive with them is the obligation they feel towards the grounds of truth and reality, the foundations of all real science, which are common to all observers.

That there should, if possible, be a science of education, founded on something more than the traditions of the art or the success of past usages, appears to be the present demand of reformers. The wide-spread and growing conviction, that universities have not advanced their knowledge of their duties to mankind or to their several nations at the same pace as other useful institutions, and that legislative interference ought to undertake what the incumbents of university places have neglected, has given so great alarm to the latter, that they have turned a most energetic and earnest attention to the subject. The discussion, so far, has developed little more than the many-sidedness and extreme difficulties in practice of the problems of education. This, together with the zeal exhibited by the best university men, to bring all the light they possess or can command to bear on the discussion, will doubtless serve the purpose about which they seem most solici-

tous, — the purpose of avoiding, if possible, revolutionary measures, and the “danger that *any* reform should be adopted because *some* reform is required.” *

The problem of the higher general education of the universities, — what it should be, whether a simple *curriculum* or a variety of courses; what constitutes nowadays a liberal education; what are its ends; what are their relative degrees of importance in a general education, or in one preparatory in a general way, as the lower school training is, to more specific studies or pursuits, — this problem has rather been exhibited in its difficulties than advanced towards a solution by recent discussions. It is well observed by Mr. Pattison, Rector of Lincoln College, Oxford, that the difficulties in which elementary education is implicated, great as they are, are difficulties of action: — “How to carry through what we know ought to be done.” “The university question is quite otherwise.” “There would be little difficulty in getting anything done, if we could see our way clearly to what we do want.” To make the reformers outside of the universities feel this, and feel that the problem can only be solved by men practically acquainted with the business of education, seems to be one of the aims of university writers. Yet, we imagine that those who demand reform, in the name of the nation, look upon these writers as they would upon men pursuing other kinds of business, who, in the practice of means honored by long usage, and especially in devising the secondary and subsidiary means, are apt to have but dim perceptions of the ends to which the machinery or appliances of the art are as a whole, or should be, adapted. The means of the higher education, like all other means in practices of which the ends are manifold, conflicting, and only vaguely conceived, are naturally enough sought for in that kind of experience which is embodied in customs and institutions, rather than in philosophy or in a scientific analysis of the experience.

Next to the claim which their acquaintance with the details of practice gives to university writers on education, they rely on this slowly developed *experiment* (as they would like to

* Suggestions on Academical Organization, with especial Reference to Oxford. By Mark Pattison, B. D. Edinburgh: Edmonston and Douglas. 1868.

have it regarded) which the past usages of universities offer to observation ; although without definite purposes or guiding questions, not implicated in an experience, its evidence can hardly be with propriety regarded as *experimental*. It is quite true, and a just complaint of conservative thinkers, that the projects of reformers, the proposed changes in subjects, text-books, and methods of the higher education, have no better title to be regarded as experiments philosophically devised. Most criticisms on what universities have done heretofore are expressions of little more than dissatisfaction with the use of text-books, or even of subjects, or with methods of teaching and examination in subjects, in which the critics have either failed, or reached only a slight proficiency ; and advice is most freely proffered by those who are least acquainted with the matters in which they demand reform.

Upon a recent discussion in a scientific periodical concerning what modern elementary treatise is best adapted to take the place of Euclid (now considered antiquated by the reformers, though still supported by Cambridge and used in the best English schools), Mr. Todhunter observes that, " what appeared singular to persons accustomed to inquiries about education, was the readiness of persons to offer advice with most imperfect knowledge of the circumstances." We may add, that what strikes the latter sort of persons as equally singular, is the firm reliance of conservative thinkers like Mr. Todhunter, on his acquaintance with these circumstances, not merely as affording evidence that existing practices are good, or can be made very good without revolution, but that they are practically the best. Mr. Todhunter is doubtless right in claiming that no text-book in elementary geometry has yet been proved superior to Euclid ; but he does not appear to us quite justly aware of the disadvantages to which all novelties in the trials and experiences (we will not say experiments) in education are unavoidably exposed. The very complete and elaborate machinery of examinations in the classics and mathematics, to which Cambridge and the best English schools have given so much studious attention, would be wanting to all modern studies, and would need to be devised with equal care before the old and new experiences could be fairly compared.

The discussion needs to be weeded of many false charges and false arguments, which are as good or as bad on one side as the other, before any substantial progress can be made. Mr. Todhunter's essays will, no doubt, do good service in this way. No one could be found in any seat of learning better qualified as an expert witness (the capacity in which he appears to prefer to engage in the discussion, rather than as an advocate). A long residence at Cambridge, and much experience in lecturing, and in examinations on mathematical subjects are his main qualifications. Intimate acquaintance with the working of the machinery of examinations, and with the adaptation of mathematical studies to different minds, makes his testimony of great value, however little regard may be had for his opinions expressed as an advocate. It is interesting to find such testimony as the following: That the majority of the younger students of a university, not distinguished in their school-days for mathematical taste and power, have been "either persons of ability whose attention was fully occupied with studies different from mathematics, or persons of scanty attainments and feeble power, who could do little more than pass the ordinary examination. I can distinctly affirm that the cases of hopeless failures in Euclid were very few; and the advantages derived from the study, even by men of feeble ability, were most decided. In comparing the performance in Euclid with that in arithmetic and algebra, there could be no doubt that the Euclid had made the deepest and most beneficial impression; in fact, it might be asserted that this constituted by far the most valuable part of the whole training to which such persons were subjected."

So far as this is testimony to the practicability of mathematical studies for all minds, it is valuable. The testimony to the value of such studies to those whose abilities are of a decidedly different bent from the mathematical may still be questioned. Throughout his essays Mr. Todhunter's sole standard of value in a university study is that quality in it by which the machinery of lectures, text-books, and "pass" and competitive examinations, with emoluments and honors, can be of direct assistance to the student. On this standard he has a decided preference for the studies of the old *curriculum*.

For these and for advanced modern studies in applied mathematics adequate tests of examination and rewards of assistance and honor for success in them are means which are within a university's power to devise or command. To lay out courses and afford material aids in studies are all that remains of what a university can do for a student, unless it is so fortunate at times as to secure the services of men of genius (not to be reckoned among its ordinary resources), who have the rare faculty of stimulating the student to hard work by the interest they impart to their teachings. On this ground Mr. Todhunter seems to us to be strong. Nothing more in the way of mental discipline seems to be justly demanded of a university than not to think too highly of its resources, and to set its machinery aside on occasions in favor of greatly endowed teachers.

It is unfortunately too true, however, that such teachers have not always had the genius or sense to know that the exception is only properly made in favor of such as themselves. They have very frequently shown determined hostility to any use of methods which differ from the action of their own spontaneous powers of discipline, and which are really all the poor means that a seat of learning can constantly and systematically provide. This hostility could be just only if the genius were endowed with untiring and immortal vigor, or could educate by his inspiration a like genius in one or more of his pupils, who might then take his place. A natural genius for teaching any subject — by which we mean making the pupil an accurate and hard worker in it, like his master — is as powerless to reproduce itself in a pupil as university examinations are. We cannot by examinations, Mr. Todhunter observes, “*create* learning or genius; it is uncertain whether we can infallibly discover them; what we detect is simply the examination-passing-power of the candidate.” Sir Humphrey Davy said “that his greatest discovery in science was Michael Faraday.” Genius does not make a genius, but discovers him. Nothing more, not so much even, could fairly be expected of the best-devised system of examinations.

“The adaptability of subjects to the exigencies of examinations” is almost the sole test which our author applies to the

question of what shall be the course or courses proper to a higher general education, although he professes not to lay too great stress on this consideration, seeing that it is quite inapplicable to courses arranged for self-training. In regard to the value of the natural and experimental sciences this test appears to be with him quite decisive, though he thinks, if candidates were few and time ample, effective examinations in these subjects might be devised. It appears to us that this work falls within the province of a university's duties and is made feasible, so far as the number of students seeking honors through competitive examinations is concerned, if the university also makes it one of its duties, as that of our own Harvard has done, to lay out various courses, adapted to special classes of intellectual tastes. But even if the "examination-value" of modern subjects should never be made equal to that of the subjects of the old *curriculum*, this does not justify the university in not making such provision and affording such aids as it can for the action of a more genuine motive to study than its ordinary machinery seeks to bring into service. It is true that, without rigid and just competitive examinations, these ulterior motives of emolument and honor could not be fairly applied to studies in which they might be of very great service; but modern subjects might in themselves, and not unfrequently do, inspire the pupil and exact from him labors in a degree comparable to the influence of the most eminent teachers. Moreover, proficiency in them is capable of tests by teachers who closely follow the student's work, and by such original work in written theses as the study may inspire. One way in which the more immediate and genuine motive, the love of a study, could be made more efficacious, is not to tempt the student away from it by too great rewards for proficiency in those studies which have a greater adaptability to examinations.

It is quite natural that the importance of a study as a means of general education should be constantly confounded, by one with Mr. Todhunter's experience, with what the university can do directly in aid of it, or with its "examination-value." Although it is true that no other studies compare with the mathematical in the exercise they require, when properly taught, of

the active powers of intellect, or the inventive and imaginative faculties of the mind, yet it is not true that the mind needs always be in a merely receptive attitude towards such studies as history or the natural sciences. Mr. Todhunter admits that, in the study of a new language, it is not altogether the receptive attention that is exercised. His chief objections to other studies compared to the mathematical are, however, that they afford no problems in their earlier stages; and, as he adds, "it is scarcely conceivable that examination papers in history or the natural sciences can offer any tolerable equivalent in merit and importance to the problems of mathematics." But it may be said, on the other hand, that mathematics offers nothing but the most uninviting entertainment to a receptive attention. Its truths, independently of the problems they suggest, have a weariness even for the adept; while languages, history, and the natural sciences, though not exercising the mind with problems in the earliest stages of the study, could and should be made to do so as soon as the active powers of intellect are mature enough. The student may be made to *seek* for more authentic or intelligible evidence both in history and the natural sciences than what his text-books afford; or he may be led to research in these subjects by comparing various authorities, or by original research; though how he could be effectively led in this search by the requisites of a formal competitive examination is not so easily determined. To many thinkers on the subject of education this last consideration would only tell against the rigidity of the type of competitive examinations, which has been developed in Cambridge from the studies of the old *curriculum* and in modern mathematics.

It is quite true that the great qualities required and developed in philosophers by original research in experimental sciences are not produced, or even approached, by the repetition of their experiments. These, from being the devices of the most vigorous activity of genius, become, in the experimental lecture-room, or even in the student's own hands in the laboratory, comparatively unimproving amusements. It is one of the weaknesses of genius to recommend enthusiastically (what is generally quite impracticable) the course by which it has manifested itself and reached conspicuous emi-

nence. Nevertheless we attribute much more value to a first-hand acquaintance with experimental processes than our author appears to do. What he considers as a defect for which "some considerable drawback should be made from the educational value of experiments, so called," is their failure. This would certainly mingle unavoidable accidents confusedly with the merits of the student's performance in a set examination; and would, doubtless, disconcert the examining board or teacher, as it often has the most skilful lecturers. But these very failures have in them an important general lesson, especially useful in correcting impressions and mental habits formed by too exclusive attention to abstract studies, and have also special lessons in their respective sciences. From the general lesson is derived an adequate appreciation of the difference between abstract or conditional theorems in science, and their exhibition in concrete phenomena. The difficulty of isolating universal and simple principles from modifying and disturbing causes in actual experiments gives an impression of the nature of physical laws very unlike what the principles of geometry might give, when not corrected by such lessons from the failure of experiments. The actual circles and straight lines of geometry are easily made to embody very closely the theorems of the science. But this is not their real use. Geometrical diagrams are not specimens or examples of the universal truths of the science, but are rather a language — an ideographic language — by which these truths are expressed and inferred.

It is a curious illustration of the need geometrical studies of the Euclidean or ancient type have of guidance from a logic especially treating of its methods and limits, that a recent English work on Logic, in use in one of our principal universities ("Jevons' Elementary Lessons in Logic"), should have represented geometrical reasoning as a kind of induction, — a reasoning from a particular specimen to all other specimens. As well might we say that the repetition of the meaning of a proposition, expressed in words by expressing it in other words, or in the same words, first printed, then spoken, is an inductive process. It is true, and may explain this confusion, that the axioms and postulates of geometry are inductions from elementary constructions, real or imagined, which are subse-

quently used ideographically to express them and their combinations in the deductions of the science. Mr. Todhunter, in his essay on Elementary Geometry, avows himself opposed to the study of logic in conjunction with geometry, as of too small advantage compared to the addition that would be made to the labors of schoolmasters. The mere fact that Euclid expands his reasonings into full syllogistic completeness is not reason enough, we admit, for requiring additional work by the teacher and student in the study of syllogisms, or in the analysis and classification of arguments. This amplification of arguments was really made by Euclid to simplify, not to add to, the labors of students and teachers. But logic in a wider sense — that is, some account of what are the self-imposed restrictions of resource and method which characterize the ancient geometry — would, we believe, be of great service to intelligent students. It is to the struggle against these restrictions that the superior value of ancient geometry, as a mental discipline, is mainly attributed by the best writers. They are like the conditions and restrictions imposed on artists and poets in the conventions of the fine arts, or on youths as laws of games and athletic sports ; to which the intellect, the conscience, and honor of youth are keenly alive. Such restrictions are in the very spirit of that spontaneous ambition for self-formation which characterizes the period of discipline ; that is, the period from late childhood to or beyond middle youth.

In respect to the special value of experimental practice to the comprehension of a science, Mr. Todhunter makes a most singular remark, perhaps intended as a humorous one. After observing that boys would doubtless delight in such practice, as they would in any other physical pursuits, like foot-ball, as compared to mental exertion, he adds concerning the value there might be to the boy of seeing with his own eyes the facts of science illustrated, that it may be said the youth is thus made to *believe* the fact more confidently ; and he then remarks : “ I say that this ought not to be the case. If he does not believe the statement of his tutor, — probably a clergyman of mature knowledge, recognized ability, and blameless character, — his suspicions are irrational, and manifest a want of the power of appreciating evidence, a want fatal to his success

in that branch of science which he is supposed to be cultivating." The power of appreciating the evidence of *testimony* would doubtless be shown deficient in the case supposed, or if the boy's *belief* was what the illustrations of experiment were useful in affecting. But the more direct effect of illustration is generally supposed to be to aid the *understanding* and *imagination*. A general statement about matters of which no illustrative or analogous instances have ever come under the student's notice is necessarily vague or even unintelligible, and is rather a subject of simple memory (or, so far as belief is concerned, of simple faith) than of rational comprehension. The latter consists in the ability to pass from the general to the particular, or from the abstract to the concrete, and to return again. This is the ladder of the intellect. Any number of formulæ, without a training of judgment and imagination by facts, any number of facts, without a training of the understanding by assured generalizations actually followed, if not originally made by the student, will fail to educate or discipline the faculty which is, *par excellence*, the mind. We do not go so far as many do in estimating the value for discipline of experimental practice. Only enough of discipline in the actual practice of experiments to enable the student to study his textbook intelligently seems to us desirable for the purposes of a general education, and independently of an ambition or design of extending the boundaries of an experimental science. This might be accomplished as our author suggests, and as Dr. Whewell believed, not by making the study of the facts in natural and experimental science a part of the business of a school, but rather a part of its recreations.

Mr. Todhunter apparently believes that the amusing has generally very little educational value; and much of what others would dignify by the name of "interesting" he seems disposed to place in this category. We should discriminate here between merely spontaneous and idle amusements and those pursuits which, because they happen to be interesting in themselves or at the outset, may not on this account be the less improving, or employ less energy or concentration of faculties than those which are hard or austere. Our author doubtless had in mind, however, a class of diversions lying in wait

for unwary students, and forming inseparable parts of certain studies. His type of studies, the mathematical, are certainly not amusing. Even their interest to the adept is of a profoundly serious character. But most studies, besides the mathematical, have tempting by-paths leading from them; and geometry, even, is not without a danger of this sort. Mr. Todhunter says: "In my experience with pupils, I learned to look with apprehension on any exhibition of artistic skill among students of mathematics; for I am sure that it is not a fancy, but an actual fact, that such a power was in many cases an obstacle to success." This observation is given in illustration of the independence of each other of different kinds of observing powers. The chemist is not (as a chemist, we should add) better qualified than another man to be a botanical observer, and the like is true between other dissimilar studies. But there is a more instructive application of the author's observation on the relations of artistic taste to geometry. The facility for drawing appears to be the only one incident to the study of geometry which tempts the student fatally into an attractive by-path from the difficult, unattractive road of the science. The comparative freedom from diverting attractions is one great advantage of mathematical studies, and we think that our author's esteem of them on this ground is just; though he appears to us not to distinguish clearly enough between the value of difficulty and the quality of irksomeness, which is not of the essence of difficulty. In the period of youth and discipline difficulties are courted and welcomed, and do not necessarily repel. On the contrary, the true end of disciplinary studies appears to be through habit to gain attractiveness, or the character of play for useful, though perhaps at first irksome exercises.

Athletic sports, to which the name "asceticism" was earliest applied in its secondary sense of improving exercises in self-formation, were not disagreeable exercises to the old Greeks; and although Mr. Todhunter looks upon their present prevalence in English universities with disfavor, he might have drawn from them lessons in the science and art of mental education. Even the training of the lower animals is not without instruction in this regard. Mathematical power, though

attainable with more or less effort by nearly every one, as our author has testified, is so difficult of attainment, and so irksome to some minds, that it may well be doubted whether general training or a liberal education ought not to be sought in many cases in a different direction. Care should be taken, of course, that the tastes opposed to mathematical pursuits should not have as their chief the taste for merely amusing or diverting pursuits, as they very likely do in most cases. Mathematical abilities seem to us strikingly similar in their relations to education to the faculty of "retrieving" in hunting-dogs; notwithstanding that metaphysicians have attempted to distinguish with characteristic profundity between the mental powers of the lower animals and those of men by *calling* the capacity of the one for improvement in mental power a susceptibility to *training*, and that of the other a capacity for *education*. It is a familiar fact to sportsmen, that unless the young dog shows a fondness for "fetching and carrying" it is almost useless to attempt to teach the accomplishment. For though fetch and carry can always, with sufficient pains, be taught, yet the means of doing this also teach a vice which makes the faculty almost useless. The dog becomes "hard-mouthed" with his game. If an attempt to remedy this fault is resorted to by training to carry anything which it is disagreeable to hold hard in the mouth, the animal will generally give up retrieving rather than the vice.

It is natural to suppose that the severe training needed to develop in some minds even a tolerable degree of proficiency in mathematics will have some such effect; a narrowing effect similar to what excessive devotion to mathematical pursuits produces in minds of greater mathematical ability. "While engaged in these pursuits a student is really occupied with a symbolical language which is exquisitely adapted for a class of conceptions which it has to represent, but which is so far removed from the language of common life, that unless care be taken to guard against the evil the mathematician is in danger of finding his command over the vernacular diminished in proportion as he becomes familiar with the dialect of abstract science." To this testimony of our author on the disadvantages of mathematical training, we may add, that the

supposed value of mathematics for training habits of accuracy is delusive. The accuracy belongs to the science objectively. There is no such thing as ambiguity or vagueness in it, or the possibility of misleading the student by these defects, except by gross carelessness on his part. He either understands fully and accurately a proposition, or a step in reasoning, or he does not understand it at all. There is in the study no discipline in detecting and avoiding the faults inherent in common language and in the expressions and reasonings of other classes of conceptions. As well might an athlete seek to become an acrobat by exercises on a wide, even, and guarded path.

Again our author says, "I do not suppose that the candidates who attain to the highest places in the Mathematical Tripos are deficient in knowledge and interest in other subjects; but I fear that omitting these more distinguished men, the remainder frequently betray a rude ignorance in much that is essential to a liberal education." But this disadvantage is not peculiar to mathematical studies. The concentration of a dull mind on any single but extensive study or class of conceptions (like the legal, for example) is apt to leave it in "rude ignorance" of many subjects, some knowledge of which, retained in the memory, is the sign, rather than the essence, of an effective liberal training. What constitutes a liberal education is, as we have said, an unsettled question, or is arbitrarily determined by conventional standards, which are less regarded now than formerly. But it obviously has, at least, these two general features; namely, an acquaintance with a wide variety of subjects, adequate and correct as far as it goes, but necessarily superficial, or at second-hand; and, secondly, such a mastery of some one or two subjects in their methods and details, as will afford an adequate measure of the knowledge, or rather of the ignorance, of the mind, in respect to subjects of which it has only a smattering.

Another disadvantage in mathematical studies, admitted by our author, is the deficiency, as a means of discipline, of the modern and higher mathematics; a defect which is incident to their very perfections. When the perfect symbolism of the higher geometry is "cultivated for examination purposes, there

is the great danger that the symbols may be used as substitutes for thought rather than as aids to thought." By this we suppose is meant that the abridged processes and notations of modern geometry make it possible for the candidate to carry the theorems and their proofs in mere memory for the most part, and without understanding, or without that rational memory, to which such symbolism is a true art; so that the examination will fail of its end. Yet in abstract subjects all thought is by means of symbols; whether these are the words of common language, the comparatively numerous and awkward steps in the expression and inference of theorems by the diagrams of the old geometry, or the refined, abridged, and effective notations of modern mathematics. The latter are substitutes for thought to the mathematician who has mastered them, in the same sense as a single philosophical term is a substitute for a paraphrase or definition. They save *useless* thought, or repetitions of thought when used as instruments of investigation, either in pure or applied mathematics; and though the thought that is thus avoided may be useful in mere discipline, yet is mainly useful, we should suppose, by serving as checks, through an easy transition to intuition, for the guidance of reasoned processes, in which the mind still feels insecure.

The true value of these notations is objective; or is in that which most essentially distinguishes the modern from ancient geometry, its direct applicability to other sciences. The ancient geometry is no longer to the physical philosopher the misleading type it once was, of pure principles, or of rational comprehension. It is nevertheless, in one respect, as good a discipline as ever in the education of the mind, and is so on account of its very defects as an instrument of investigation. Its self-imposed restrictions of method adapt it pre-eminently to the spirit and uses of discipline. The modern mathematics are really as distinct from it in essential characteristics as from logic or grammar. Compared to ancient geometry, the objective ulterior value, the usefulness, independently of discipline, of the modern mathematics is immense. The various branches of exact physical science are closed studies to those who have not gained possession of this instrument of all exact inquiry. These can only view the outside of

the temple. "Admission to its sanctuary, and to the privileges and feelings of a votary, is only to be gained," as Sir John Herschel says of astronomy, "by one means,— sound and sufficient knowledge of mathematics." The relative claims of this immediate use of a study and of its disciplinary use or "examination value" are chiefly considered by writers on education in relation to the limits of time they propose for disciplinary studies in general. Mr. Todhunter objects to "the continuance of examinations far into the years of manhood," and also "regrets to see this discipline commenced at too early an age." In the former usage of his university, "when mathematical studies were regarded mainly as a discipline they were frequently entirely dropped or indefinitely postponed when the period of undergraduate discipline was completed." The most eminent scholars were thus sent forth from the universities, having made only a tantalizing approach to any direct use of mathematical skill, and deficient in a knowledge which many of them must afterwards have felt to be an essential part of a liberal education.

What we call the objective value of a science is what should be meant by calling it "useful knowledge." For if the specific utility of any knowledge is not indicated by calling it useful, this term can only mean that the value of the knowledge is not especially in itself, as distinguished from ignorance, error, or stupidity; or is not the kind of value which a well-ascertained but isolated, unrelated fact may yet have as a mere fact; such as the number of leaves on a given bush. In the acquisition and memory of such facts idiots not unfrequently emulate philosophers. The philosopher's advantage is that he has the power to select the related or the useful facts and to forget the rest. This selection is the prime function of intellect. The usefulness of knowledge is in its relatedness or ulterior value, whether as leading to other and wider ranges of knowledge, or as a discipline of the mind, or even as leading to "bread and butter." This last utility is what the unqualified term "useful" generally refers to in common language. Hence the objection to its employment. The popular teaching of natural and experimental sciences by lectures has in recent times been practised apparently on the ground that they are

useful in this sense. It is doubtless true that astronomy, chemistry, and physics are deserving of honor from the unlearned, as well as from scholars, on account of the great incidental services (not generally designed or anticipated in their pursuit) which they have rendered to the arts of life; or on account of their utility in the narrowest, most destitute sense of the word. Wealth and leisure are indispensable requisites to the philosopher's and scholar's pursuits; and it may be said that the means by which these are secured for their pursuits, in any community, ought to be prominent objects of their study and care. Yet, if such had been the motives of physical philosophers in their pursuit of such a subject as electrics, or magnetism and galvanism, if wider, vaguer, less-defined utilities, or relations of knowledge, had not been the almost exclusive motives of this pursuit, it is almost certain that the many useful applications of electrics in the arts would never have been reached. The same is true of other branches of physical and natural science and of applied mathematics. The utility of non-utilitarian motives (in the narrowest sense of the terms) justifies the motives even from the lowest grounds. Where it is demonstrable, as we might suppose it to be of comparative philology and the science of language, that the pursuit can never lead to any such results,* and is even deficient in applicability to university examination purposes, yet even here the spirit of the pursuit is the same as in natural and experimental science, and it is to this spirit, rather than to its occasional and incidental services, in unforeseen ways, that honor for the service is due.

Not only the knowledge which has thus been popularly honored, but all "useful knowledge," in this wide sense, should be fostered by the universities. That which, however, needs especially the care of the universities, is the knowledge which is not, and does not promise to be, useful in an economical sense; the pursuit of which is not stimulated by the prospect of rewards, in fees or wages, or in any ways proportionately to the exertion made. "If," says Mill, "we were

* The recognized political value to English rule in India of studies in these sciences by European scholars preclude, however, the supposition of even such an exception.

asked for what end, above all others, endowed universities exist, or ought to exist, we should answer, 'To keep alive philosophy.' " It is, of course, in the devising and working of its machinery that the time and energies of the officers of a university are chiefly employed; by which young men are helped, encouraged, and tested in their pursuits of culture, and are then sent out into the world bettered in ability and character by the discipline they have received. "How," it may be asked, "can this be a service to philosophy, and to the knowledge which is useful only in a higher sense?" "Our obligations are to the nation, not to philosophy," the university officers might answer. "We are bound to see that the young men who come to us become thorough and accurate students of whatever studies they pursue, and become prepared for their duties in life by the discipline most conducive to accuracy and scholarship. The studies best adapted as means to these ends are the studies we must foster. We must be able to unmask ignorance in our 'pass' examinations; to reveal knowledge in our competitive ones; to compare competitors justly and to reward the most successful. If the studies chosen for these ends are not sufficiently philosophical, then we must sacrifice philosophy to our duty to the nation."

We believe we have not overstated in the above the views, and the point of view, of the university men who think at all about the subject. Perhaps more attention to the claims of philosophy, or of a knowledge for the sake of a higher knowledge, would have avoided or remedied the defects which our author finds in the Cambridge system of examinations. He is disposed apparently to go back to past usages, though he sees little to encourage the hope of a return. "In the study of mathematics formerly, as a discipline, a general knowledge of the principles was all that was required; now," he adds, "we insist on a minute investigation of every incidental part of the subject. Exceptions and isolated difficulties seem to receive undue attention on account of their utility for the examiner's purpose." Again he says, "As a general principle it may be said that the older practice in education was to aim at the discipline of the mind, and that the modern seeks to store it with information." And again, "It may be, I think,

justly charged upon our examinations that the memory is over-cultivated and rewarded. As I have already said, examinations in some subjects, as in languages, for example, must necessarily be almost exclusively tests of the memory; but what we may regret to see is that in examinations in subjects with which the reasoning power is supposed to be mainly concerned, the memory should be severely taxed."

On the other hand he repels the charge against the examination system that it encourages *cramming*. This term as applied to various practices seems to him to lack any fixed definite meaning, other than an implied censure of rigorous examinations in general. He conjectures that one definite meaning in the word may relate to the tendency in examinations to over-cultivation and over-appreciation of the memory. But he denies that this is a fault or an avoidable one in such subjects as *language*, in which "it would seem, from the nature of the case, that the memory must be the principal faculty that is tested." Special and exclusive devotion to a single study in completing a school-boy's preparation for an examination does not appear to him to be properly called *cramming*, or at any rate to deserve the reprobation meant to be conveyed by "this absurd and unmeaning word." Our author's reprobation of this word, and of the criticism on examinations in general conveyed by its use, is a key to his whole theory of education; or at least defines the position from which his observations were made, and by which the bearings and value of his testimony should be estimated. There is, it seems to us, a slight inconsistency in objecting, as he does, to the value of natural and experimental sciences, as a discipline, on account of the time and pains needed for examinations in them, which he thinks would be excessive; at the same time admitting in regard to the studies he approves of, that undue attention to exceptions and isolated difficulties in them is given on account of the utility of these to the examiner's purpose. That is, he contrasts two kinds of studies in respect to defects, which it appears both would have, but which are really due to a system that does not admit, on account of these defects, of application to both kinds at once.

The examiner's purposes, the secondary or subsidiary means

of discipline, are likely in his pursuit, as means are in all other pursuits, to receive undue attention, and the proximate means to the true ends to become ends in themselves; especially, as we have said, when custom or long usage has sanctioned them and is the easiest escape from difficult questions. How to make the studies previously found useful in discipline still more useful; how to avoid defects in the examinations, to prevent the memory from doing the proper work of the reason in these tests of proficiency; how to prevent the evils, whatever they may be, of *cramming*, are the highest problems in education to which university men generally give their attention. To them it is a sufficient objection to modern studies as means of discipline that they are not fixed or finished sciences, but are constantly undergoing changes and improvements at the hands of special adepts, which are more fundamental than the changes, improvements, and expansions made in older subjects solely with reference to their use in education. In short, the officers of universities are as innocent of philosophy as most other men in business generally are. "The fashionable subjects of the day" disconcert the examiner. If these are capable of inspiring a patient and laborious attention in the student by their own inherent interest, it is well. This is the way in which they may be useful, but the professor and the examiner with his rewards of assistance and honor have no concern in it; or their duties are done by putting the new subjects into the highest examination papers.

The corporate spirit, the conscious union of aims and the purposes common to all in such a university, is not a very high one. Conservatism, reverence for the traditions of the university, attachment to it as a family of scholars, pride in it for the importance of its services to the nation and to mankind, are the sum of its conscious virtues, the limits of its aspirations. If so be philosophy seeks or can find entertainment in this family, she is welcome; but is still a guest, not an inmate. If it were not for the wealth or the appropriations of it which serve to consolidate these as well as other families, it might be otherwise. Philosophers were so named because they refused the pittance of schoolmasters; but it is difficult to see how they could have lived without them, or what was equivalent to

them (though called by a different name), if they happened to be poor, as they generally were. But it is not perhaps by a disposal of means essentially different from what now prevails in universities, that a remedy for their defects is to be sought. It is rather by a different *spirit* of disposal. *In order that the distribution of assistance and honors might be perfectly just, a system has been devised which inevitably places ulterior motives to study in the first rank of incitements.* A definite though factitious direction thus given to the efforts of teachers is the best excuse that can be clearly urged for this promotion of ulterior incitements to study. Comparatively few candidates continue throughout their academic course to be stimulated by them, the majority being soon distanced; yet these few are those who least need or are really profited by such discipline; while the majority have their studies chosen for them on such irrelevant grounds as would be disregarded in a choice of courses arranged for self-training, namely, "the adaptability of subjects to the exigencies of examinations." We admit the difficulties of reform, while insisting on its importance. It is at least one step towards it to recognize this importance, and to know, however painful the consciousness may be, that our loyalty and pride are not fixed upon the highest objects; that a justice which cannot go by favor is yet not the greatest justice. It is not the justice of natural families, nor of families of philosophers. These may not reach practically a very high type; they seek, however, for justice through other means than regulations; they love to receive it at the hands of honest and intelligent generosity, rather than win it from the hands of inflexible law. One would suppose that in a university, if anywhere among men, this dangerous, impracticable higher justice might find a seat; but an English university would be the last place where one would wisely seek for it. Such is the influence of competitive examinations, that the justice of them is more hostile to this rival than to any form of injustice. This may be because the rival is, in a university, a really formidable and dangerous one; so that it becomes the chief business of the reigning power to maintain its throne. At any rate Mr. Todhunter thinks it highly important that the justice of competitive examinations should be additionally guarded, by exclud-

ing teachers rigidly from the examinations of their own pupils in competition with others. This is indeed a confession of an inherent, rather than an incidental weakness in the system.

That the ends of a liberal education are manifold, and are vaguely conceived in their just proportions; that the means to the various ends, which may be consciously sought, are often conflicting; and that the attention of those who make education their business is definitely directed by a traditional *curriculum* to the subsidiary means of perfecting its use, — are perhaps sufficient explanations of the feeble attention given by scholars to the higher or ultimate ends of training. That our author, with all his study and experience in this subject, should have failed to discover any definite meaning in the word *cramming* beyond its implied censure of rigorous examinations is, therefore, not surprising. If we may venture to say in a sentence what the word commonly means, when used intelligently, we may say that a given amount of studious attention, either rational or merely mnemonic, given to a subject exclusively and for a short time, gives to the mind a different and a less persistent or valuable hold on the subject than the same amount and kind of attention spread over a longer time and interrupted by other pursuits. This mode of study and its defects are what we conceive the word *cram* is meant to express, and at the same time to censure.

All modes of study involve, of course, *repetitions* of such degrees of attention to a fact or conception or inference as the student's powers can command. By these repetitions the memory is made firm and persistent. But there are two very different modes of repetition: first, by repeated acts of *direct* attention; secondly, by repeated recalls or recollections. The latter has two varieties, namely, being repeatedly reminded by associated thoughts or objects of the things remembered, and performing repeated acts of voluntary recollection or research in reminiscence. The last is the only *active* exercise of memory, and is, of course, most strengthening to a *command* of memory. But both these varieties, and especially the latter, require, for disciplinary exercise and trial, interposed intervals and diversions of attention; and the longer the intervals are, if not too long, the more the essential or rational, and the far-

reaching or constructive associations of thought come into play, or the more the "reason" is cultivated, according to the common expression of this practically well-known fact. The reason is a slow growth, and cannot be forced in any study, though in some it may readily be blighted.

There is a popular opinion, shared by some philosophers, that great memory and sound judgment are incompatible, and the words *Beati memoria expectantes judicium* express this supposed incompatibility. And there is a basis, doubtless, for this belief. The more essential or rational and the far-reaching or constructive associations of thought are by far the most durable, and constitute the inner life, or sub-conscious action of thought; though the associations which are temporarily stronger are most readily commanded, or are parts of the present volitional power of the mind. In other words, the retentiveness of memory as distinguished from recollection, or from the power of ready recall, depends on the thoroughness of understanding, or on the number of links of mental habitude binding together and leading to the things remembered. The apparent contradiction, which Sir W. Hamilton regards as a real one, between the great learning of the philosophic scholar, Joseph Scaliger, and his statement that he had not a good memory but a good reminiscence, that proper names did not easily recur to him, but when thinking on them he could find them out, is a good illustration of the distinction between the readiness of a sensuous or first-hand memory by rote, and the more durable memory of a reflective and subtle understanding, which involves a greater real command with sufficient pains, though not so ready a command of remembered objects. There was no real inconsistency between Scaliger's confession and his great learning, or even the readiness of his memory on occasions. His own testimony is worth much more about his own memory than any contemporary's judgment from his talks, such as Sir W. Hamilton quotes in his *Metaphysics* (Lecture XXX.). Reminiscence appears to have been used by him in the sense of a power of attention to recover what did not readily recur to him, and ought in this sense to be distinguished both from mere retentiveness and from readiness of recollection; the latter being the sense in which he used the word *memory*.

But so far are sound judgment and memory, in a wider sense than this, from being incompatible, that judgment is in fact a form of memory, — the most subtle and serviceable, though least readily commanded. It is the memory or the retentiveness of understanding, or of the generalizing faculty ; just as what is commonly called memory is the retentiveness of imagination, or of the faculty of individual and concrete representations. The soundness or excellence of both forms depends, of course, on the powers of attention and primary perception.

“ That the memory is over cultivated and rewarded ” by the incitements and exactions of examinations in Cambridge is what our author admits. That this is due to the mode of study they encourage is what he has failed to see. The abuse to which examinations are liable of testing memory when the faculty of reason is the one under examination is a fault which our author has seen, as an examiner in mathematics, and against which he believes the examinations can and should be guarded ; and it is not, therefore, he thinks, one which ought to condemn the system. And so far we go along with him, but the real defect of the system is subtler than this.

Examinations may be guarded against mistaking a simple memory of the lowest order, or mere memory, for a rational comprehension of a subject ; but the faculties trained by mental discipline are not so simply classified as writers on education appear to think when they enumerate them as memory, reason, and invention or imagination. There are various kinds and orders of memory, and *the highest of these, together with the highest order of invention, involves the faculty called reason.* The faculties which ought to be tested by examination are properly *memory* and *invention* in their various orders, and in the kinds in which various studies have disciplined them. Examinations in languages and history are mainly tests of memory, Mr. Todhunter thinks ; but how different are the orders of memory involved even in these ! How different is the child's memory of stories from that of a student of comparative mythology ! A quick, retentive child's memory will note every variation in repeated recitals of a tale, and will correct the story-teller on points which seem to the adult mind quite trivial, but are in

fact to the child essential enough to make a different story. When the comparative mythologist, on the other hand, finds identity amidst the varieties of legendary tales of various races and nations, his memory of them is of a different order from the child's. History or language may be remembered in these different ways, and no *system* of competitive examinations would be able to detect the difference. A difficult construction in an author writing in an ancient or a foreign language might be satisfactorily construed by the candidate either because he retained in simple memory, as an isolated fact, the explanation of it given by his tutor (which might be much more rational than the student could gather from a literal translation), or because he had, like his tutor, met and noted parallel or analogous constructions in the same or in other authors (thus exercising his reason in a still better way). How vastly superior, indeed, the latter form of memory is, in persistency, in utility for professional employments, and in the satisfaction of thought itself as a mental exercise ! If this cannot be distinguished by formal examinations from lower orders of memory, the fact ought to tell against the system rather than against those studies which are ill-adapted to it, and which include almost all except mathematical studies ; or even include these when the system is not elaborated to the perfection it now has in Cambridge.

A broad distinction in the kinds of mental association, dominant in different orders of memory, is familiar to psychologists, though apparently not to most writers on education. The associations of mere contiguity or consecutiveness are characteristic of the child's mind and of imaginative poetical persons. A low order of invention goes along with them, namely, the order of poetical or artistic invention, which is intellectually inferior, and is not cultivated systematically by universities, although valuable to the artist or poet, and highly influential in works of genius. If the memory dependent on this kind of association is naturally strong, and continues after childhood with but little systematic practice or effort, it may be regarded as a positive advantage to the mind, as a form of native strength ; though the exercises and mental habits required for the cultivation of it are directly opposed to those needed for the cultivation of the higher or rational memory and invention. Com-

mitting pages of rhythmical verses or simple elegant prose to memory, though not exclusively dependent on associations of the lowest order, yet depends very largely on them, and interferes as a habit with the habits which bring into play the other kind of associations which psychologists have distinguished, namely, the associations of similarity. This kind of associations brings together resembling, analogous, or identical parts in different trains of contiguous or consecutive impressions, or drops from these trains into oblivion all the parts that have not with the rest ties of this sort, or else the contrasted ones of *dissimilarity*. The associations of similarity are those of rational comprehension in memory and invention. They dissolve the ties of the other sort, which are relatively so strong in children, in natural arithmeticians, and often in the undeveloped minds of idiots. The two sorts rarely exist together in great perfection, or except in men of eminent genius, whose native powers of attention are equal to those of two ordinary minds.

Hence for minds which schools and universities undertake to train, the needed discipline is not the training of two distinct and unrelated faculties (the memory and reason), by studies specifically chosen to test their proficiency; but it is the supplementing of a lower and original, or early developed form of memory and invention by a higher one, even at the expense of supplanting the lower in great measure. In the most rational of studies, the mathematical, the constituents which depend on mere memory, or the lowest kind of association, are the fewest, and the play of invention, in the constructive action of rational imagination, is the greatest. Perhaps the latter is too great for a symmetrical training of the mind; since, in a genuine pursuit of mathematics, the lower form of memory is apt with ordinary minds to be enfeebled by it. The lower form of memory is still a very valuable one; though the cheapness of books and writing-materials dispenses with many of its services. Even *cramming*, or the getting up of a subject in the shortest time, which depends largely on powers of retention of this sort, and but little on the fixed habits formed by studies more prolonged, might on this ground be commended; though *cramming* mathematics for examination would obvi-

ously not be the best course ; since other studies, pursued properly, would more directly and profitably exercise these powers by the concentration of attention.

The *ability* to "cram," which such work in the universities must, of course, cultivate, has been thought to be an element of success in various pursuits of life, as with the statesman, the general, the lawyer, and with men of business ; but we are inclined to believe that the use in these pursuits of the lower form of memory is secured to successful men by their ability to stimulate its action on occasions by throwing into it their superior energies of purpose, emotion, or will, rather than by university practice of this sort. Light is thrown on this subject by the well-known facts in psychology, that the lower memory depends on two distinct causes, on the *repetition* and on the *intensity* of impressions ; and that impressions which are at all relevant to states of strong emotion are more deeply and persistently impressed than under ordinary circumstances. Even trivial, irrelevant circumstances attending or coming under our notice in states of strong emotion are long retained in the memory. If this be the true explanation of the great service which the lower memory sometimes renders to eminent minds, it would follow that it is not by the direct cultivation of the memory, but rather by cultivating this cause of it that discipline can be useful ; that is, by exercises which stimulate to energetic action the emotions and the will. Athletic training and exercises are of this sort, and though they do not employ the memory, may yet, by the sustained mental effort required in them, educate the character to a better command of memory on fitter occasions. No faculty is in general more susceptible of training than that of attention *in the directions in which it is spontaneous* ; and, on the other hand, no faculty is more dependent on the native aptitudes and powers which direct it. The antithesis is due to the extreme generality of the term "attention," which includes in its meaning both the original or spontaneous powers of the mind, and those which discipline is capable of perfecting or improving with reference to any standard. Much of the superiority of eminent minds is, doubtless, in a native or early acquired degree and kind of power in attention, which none of the motives of direct disci-

pline can create. This is true also of the lower animals ; superior native or spontaneously acquired powers of attention being regarded by their trainers as indispensable to success in training them. Of this contrast between genius or native character and ordinary mental ability, genius itself is not in general made aware by comparison with ordinary standards, but usually attributes its success to a prolonged and patient concentration of an ordinary attention, which is merely voluntary ; thus converting into a merit, or a moral superiority, what are really gifts of nature. But in this explanation of itself neither genius nor character takes account of the motives or the pleasures of action and effort which make patient labor and sacrifice easier for it than for inferior orders of minds, for whom moral incitements and rewards are, therefore, more needed ; and genius is apt to take no account of the finer quality of its powers of attention, which it attributes to the objects or the occasions to which its efforts are "accidentally directed." The pre-eminence of genius and of native character is really manifested in the equality of abilities to exceptionally difficult works ; though it is made indubitably evident and a subject for fame and history only in the latter, as compared to the results of ordinary abilities.

Command of the lower memory is doubtless improved by the mastery of some one or two subjects ; the more special and narrow they are, the better, perhaps, for saving time ; and even if they do not belong to what is commonly accounted essential to a liberal education. It should, however, be such a mastery as is conducive to the formation of mental habits, and not such as can be compassed by *cramming*, or the exclusive study of any subject for a special purpose and in a limited time. A young officer of the Union army in our late struggle, in a letter written on the evening before the battle in which his life was sacrificed, attributed his previous successes, and rapid promotion to responsible duties, to a six months' study of *turtles* at the Zoölogical Museum of Harvard University, which was undertaken merely from the youthful instinct of mastery, or appreciation of the value of discipline, and was interrupted by the breaking out of the war and the young man's enlistment in the service. Perhaps, however, the inde-

pendence of character which determined this choice of means for discipline was the real source of the success which the youth too modestly attributed to the discipline itself.

It is all-important in considering the problems of education to have clearly before our minds what are its true ends and its most direct proximate means. This is far more important, in a philosophical consideration of the subject, than any amount of evidence on the working of a system of subsidiary means supposed to be adapted to ends very ill understood. It is a far more important question than that to which answer is made in the testimony of experienced teachers and examiners as to the value of any system of examinations for testing a youth's "examination-passing-power." This testimony may be good evidence that a university is really doing, and doing faithfully, what it professes to do; but it is not a proof that its system is the best, or that its ideas of a liberal education are soundly based either in experience or philosophy. It is not a proof that philosophy is kept alive in such a university, even to the degree of inspiring a hope beyond the seeming practicable, or creating any desire for a wider range of influence, or for a more comprehensive knowledge of its duties.

CHAUNCEY WRIGHT.

ART. III. — AN EPISODE IN MUNICIPAL GOVERNMENT.

III. THE RING CHARTER.

THE Tammany Ring charter for New York City was passed in the month of April, 1870; it was in July, 1871, that the New York "Times" electrified the whole community by the earliest authentic exposure of the frauds of those who under it had been intrusted with a power little less than supreme. The fifteen months intervening between these two dates were halcyon days to Messrs. Tweed, Sweeny, Hall, Connolly, and their coadjutors and satellites; for, though not devoid of anxieties and forebodings, those were the months in which the Ring was at the acme of its glory; it seemed actually under